CLAIMS

What is claimed is:

1. A high temperature superconductor mini-filter comprising:

(a) a substrate having a front side and a back side;

(b) at least two self-resonant spiral resonators in intimate contact with the front side of the substrate, each of said resonators independently comprising a high temperature superconductor line oriented in a spiral fashion (i) such that adjacent lines are spaced from each other by a gap distance which is less than the line width; and (ii) so as to form a central opening within the spiral, the dimensions of which are approximately equal to the gap distance;

(c) at least one inter-resonator coupling;

(d) an input coupling circuit comprising a transmission line with a first end connected to an input connector of the filter and a second end coupled to a first one of the at least two self-resonant spiral resonators;

(e) an output coupling circuit comprising a transmission line with a first end connected to an output connector of the filter and a second end coupled to a last one of the at least two self-resonant spiral resonators;

(f) a blank high temperature superconductor film disposed on the back side of the substrate as a ground plane;

(g) a film disposed on the blank high temperature superconductor film as the contact to a case for said mini-filter;

(h) a superstrate having a front side and a back side, wherein the front side of the superstrate is positioned in intimate contact with the at least two resonators disposed on the front side of the substrate;

(i) a second blank high temperature superconductor film disposed at the back side of the superstrate as a ground plane; and

(j) a second film disposed on the surface of said second high temperature superconductor film as a contact to a case for said mini-filter.

2. The mini-filter of Claim 1 wherein the superstrate is smaller in size than the substrate; and wherein the first end of the input coupling circuit and the first end of the output coupling circuit are each located outside the dimensions of the superstrate.

3. A high temperature superconductor mini-multiplexer comprising:

(a) at least two mini-filters, each mini-filter having a frequency band which is different from and does not overlap with the frequency bands of each other mini-filter;

(b) a distribution network with one common port as an input for the mini-multiplexer and multiple distributing ports, wherein one distributing port is connected to a corresponding input of one mini-filter; and

(c) a multiple of output lines, wherein one output line is connected to a corresponding output of one mini-filter;

wherein each of said at least two mini-filters comprises:

(d) a substrate having a front side and a back side;

(e) at least two self-resonant spiral resonators in intimate contact with the front side of the substrate, each of said resonators independently comprising a high temperature superconductor line oriented in a spiral fashion (i) such that adjacent lines are spaced from each other by a gap distance which is less than the line width; and (ii) so as to form a central opening within the spiral, the dimensions of which are approximately equal to the gap distance;

(f) at least one inter-resonator coupling;

(g) an input coupling circuit comprising a transmission line with a first end connected to an input connector of the filter and a second end coupled to a first one of the at least two self-resonant spiral resonators;

(h) an output coupling circuit comprising a transmission line with a first end connected to an output connector of the filter and a second end coupled to a last one of the at least two self-resonant spiral resonators;

(i) a blank high temperature superconductor film disposed on the back side of the substrate as a ground plane; and

(j) a film disposed on the blank high temperature superconductor film as the contact to a case for said mini-filter.

4. The mini-multiplexer of Claim 3 wherein each of said self-resonant spiral resonators has a shape selected from the group consisting of rectangular, rectangular with rounded corners, polygon and circular.

5. The mini-multiplexer of Claim 3 wherein a conductive tuning pad is disposed in the central

opening of one or more of said self-resonant spiral resonators.

6. The mini-multiplexer of Claim 3 wherein each self-resonant spiral resonator is selected from the group consisting of $YBa_2Cu_3O_7$, $Tl_2Ba_2CaCu_2O_8$, $TlBa_2Ca_2Cu_3O_9$, $(TlPb)Sr_2CaCu_2O_7$ and $(TlPb)Sr_2Ca_2Cu_3O_9$.

7. The mini-multiplexer of Claim 3 wherein each high temperature superconductor film is selected from the group consisting of $YBa_2Cu_3O_7$, $Tl_2Ba_2CaCu_2O_8$, $TlBa_2Ca_2Cu_3O_9$, $(TlPb)Sr_2CaCu_2O_7$ and $(TlPb)Sr_2Ca_2Cu_3O_9$.

8. The mini-multiplexer of Claim 3 wherein each substrate is selected from the group consisting of $LaAlO_3$, MgO, $LiNbO_3$, sapphire and quartz.

9. The mini-multiplexer of Claim 3 wherein one or more of said mini-filters contains an odd number of self-resonant spiral resonators with one resonator being centrally located and wherein the centrally located resonator comprises a double spiral form resonator comprising two connected spiral lines with a 180-degree rotational symmetry.

10. The mini-multiplexer of Claim 3 wherein all self-resonant spiral resonators have an identical configuration selected from the group consisting of rectangles, rectangles with rounded corners, polygons and circles.

11. The mini-multiplexer of Claim 3 wherein the input and output coupling circuits are in the parallel lines form and each comprises:

(a) a microstrip line,

(b) a gap between the said microstrip line and the first resonator for the input coupling circuit, or the last resonator for the output coupling circuit, of the said mini-filter, and

(c) a gold pad at the end the microstrip line.

12. The mini-multiplexer of Claim 3 wherein one or more of said mini-filters further comprises:

(k) a superstrate having a front side and a back side, wherein the front side of the superstrate is positioned in intimate contact with the at least two resonators disposed on the front side of the substrate;

(l) a second blank high temperature superconductor film disposed at the back side of the superstrate as a ground plane; and

(m) a second film disposed on the surface of said second high temperature superconductor film as a contact to said case for said mini-filter.

13. The mini-multiplexer of Claim 12 wherein the superstrate is smaller in size than the substrate; and wherein the first end of the input coupling circuit and the first end of the output coupling circuit are each located outside the dimensions of the superstrate.

14. The mini-multiplexer of Claim 12 wherein each high temperature superconductor film is selected from the group consisting of $YBa_2Cu_3O_7$, $Tl_2Ba_2CaCu_2O_8$, $TlBa_2Ca_2Cu_3O_9$, $(TlPb)Sr_2CaCu_2O_7$ and $(TlPb)Sr_2Ca_2Cu_3O_9$.

15. The mini-multiplexer of Claim 12 wherein each substrate and superstrate are selected from the group consisting of $LaAlO_3$, MgO, $LiNbO_3$, sapphire and quartz.

16. The mini-multiplexer of Claim 12 wherein a conductive tuning pad is disposed in the central opening of one or more of said self-resonant spiral resonators.

17. The mini-multiplexer of Claim 12 wherein each self-resonant spiral resonator is selected from the group consisting of $YBa_2Cu_3O_7$, $Tl_2Ba_2CaCu_2O_8$, $TlBa_2Ca_2Cu_3O_9$, $(TlPb)Sr_2CaCu_2O_7$ and $(TlPb)Sr_2Ca_2Cu_3O_9$.